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Copy 6 of 6

7 November 1963

MEMORANDUM FOR THE RECORD

SUBJECT : Exploration of the Potential Vulnerability of OXCART to Lightning Discharges--

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REFERENCE : dtd. 4 November 1963

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1. The ability of KEMPSTER B to perform is related to the affect of accumulated electrical charge upon the "O" vehicle, which, if of a positive character, may require charge neutralization.

2. The undersigned recently found that there was a mutual concern vis a' vis the vulnerability of OXCART to the lightning discharges when of LAC, Burbank, visited here at Headquarters on 24-25 October 1963.

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3. Information on the lightning problem was exchanged, and the undersigned arranged an exploratory trip to

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4. Along with the referenced visit to and the undersigned met with Concluding this meeting was a tour of the facilities there.

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5. The has a capability of simulation of natural lightning discharges on a cloud to cloud, cloud to ground or vice versa on full-size or scale models. The scaling of the simulated discharge on models is accomplished by changing the rise time of the discharge current in direct proportion to the

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scale of the model, i.e., for a 1/5th scale model, the simulated lightning discharge rise time will be 1/5th that for full scale. A typical "lightning bolt" will be in excess of 5 1/2 million volts with a peak current at about 40,000 amperes in a microsecond or so. This produces the explosive effect of the lightning. However, preliminary to the foregoing, there will be a lower current of about 400 amperes lasting for 1/4 microsecond which produces the burning effects. Studies have been made of the affects of lightning upon aircraft, such as the burning of holes in fuel tanks, destruction plastic propellers, etc. From these studies, the protection of the structure from damage by lightning can be studied.

6. In view of the accumulated experience with lightning, the undersigned believes that the structural and mission characteristics of OXCART lend themselves to the prediction that there will be considerable lightning hazard, not only from the standpoint of explosive effects, but also from the burning effects of the lightning stroke. In an extreme view, OXCART in the performance environment can become a shock-excited antenna array. One should expect standing waves of voltage and current, conceivably of the kind that might cause lightning discharges between the rudders or between a rudder and the fuel tank to occur. By the same token, OXCART may act as a charged cloud with the ionized exhausts acting as the points of entry of the lightning stroke discharged to the "O" vehicle from a cloud. It should be noted that cloud-to-cloud strokes are four times the frequency of cloud-to-ground or vice-versa.

7. The problem of discharge of accumulated charge upon the "O" vehicle incident to approach for refueling from a tanker aircraft requires careful consideration.

25X1 8. [redacted] OSA, has queried Weather Central on meteorogical data relative to lightning strikes on aircraft and also SAC operations relative to lightning discharges incident to the refueling operation.

9. The undersigned believes that the [redacted] 25X1
25X1 [redacted] offers a unique opportunity for cloud to "O" vehicle scale-model studies to assess the burning and explosive damage that a full-scale aircraft partially covered with AR material might suffer. The solution of the problem of lightning hazards is believed to be the same as the solution of the problem of charge neutralization of the "O" vehicle for the effective operation of KEMPSTER B.

10. It is estimated that three to four days of 25X1
experimental work in the [redacted]
could give the required solution to the problems at
an estimated price of [redacted] a day for one 25X1
engineer and three high-voltage technicians on the
floor along with exclusive rental of the facilities
of the [redacted] for that 25X1
period.

11. It is recommended that a decision to proceed on a lightning vulnerability investigation on OXCART be made at an early date because O-2 clearance background investigations would have to be made on:

1 Engineering Manager
1 High-Voltage Engineer
3 High-Voltage Technicians

soon, in order to begin the work shortly after the first of the year.

SIGNED

[redacted] 25X1
Engineering and Analysis Division
(Special Activities)

25X1 Attachments: [redacted]

EAD/OSA: [redacted] 25X1
Cy 1 - EAD/OSA (thru ADD/S&T)
2 - AD/OSA w/o att.
3 - D/TECH/OSA w/o att.
4 - CD/OSA w/o att.
5 - EAD/OSA w/o att.
6 - RB/OSA w/o att.